NOMENCLATURE OF SELECTED SILICATE MINERALS AND THEIR ASBESTIFORM COUNTERPARTS

Many silicate minerals occur in two forms, asbestiform and non-asbestiform. Each non-asbestiform mineral and its asbestiform counterpart have the same chemical composition and crystal structure, differing only in manner of crystal growth. Asbestos fibers result from unique crystal growth in only one dimension whereas non-asbestiform mineral conditions, which constitute more than 99 percent of silicate mineral occurrences, are the product of two- or three-dimensional growth.

The three most common asbestos minerals are chrysotile, crocidolite and amosite. These names are used in government regulations to designate the minerals to be included in the definition of asbestos. Their non-asbestiform counterparts, which are never included in the definition are known as antigorite, riebeckite and grunerite, respectively.

Three other minerals usually listed under the definition of asbestos in government regulations are anthophyllite asbestos, tremolite asbestos, and actinolite asbestos. For these substances the word "asbestos" must be added to the mineral name, because their rare asbestos forms have no separate specific designation, in part due to the limited commercial availability of the form. Therefore, in government asbestos regulations the use of the unqualified mineral names anthophyllite, tremolite and actinolite must be avoided when reference to the asbestos types of these three minerals is intended; otherwise both the non-asbestiform and asbestiform varieties become regulated substances. The intent of the government to exclude non-asbestiform varieties of silicate minerals is clear, in view of the absence of the terms antigorite, riebeckite and grunerite in the definition of asbestos in any government asbestos regulation.

In early government asbestos regulations such as those promulgated by the Occupational Safety and Health Administration (OSHA) and the Environmental Protection Agency (EPA), the need to differentiate between the two forms of anthophyllite, tremolite and actinolite was not recognized. However, the Consumer Product Safety Commission,[1] the Mine Safety and Health Administration,[2,3] the Bureau of Mines,[4,9] the Department of Transportation,[5] and EPA[6] have now acknowledged the need to qualify properly the silicate minerals they intend to regulate under the asbestos standards. Therefore, they have designated the asbestiform varieties of anthophyllite, tremolite, and actinolite as anthophyllite asbestos, tremolite asbestos, and actinolite asbestos. This follows appropriately the mineral nomenclature recommended by Berger and Oesper in *Asbestos Fundamentals*[7] and by Hodgson in *Fibrous Silicates*.[8] Furthermore, the proper designation of non-asbestos and asbestos minerals is quite clearly set forth in the Information Circular by Campbell, et al.[9] The many illustrations in this circular, which is available from the Bureau of Mines, help explain the problems associated with silicate mineral characterization and identification.

In order to carry out the function of regulating asbestos in the workplace, the Mine Safety and Health Administration requested CAS Registry Numbers for anthophyllite asbestos, tremolite asbestos and actinolite asbestos. The Chemical Abstracts Service fulfilled the request and in addition updated its mineral nomenclature by substituting "grunerite asbestos" for "amosite" in order to conform with International Mineralogical Association recommendations.[10] For purposes of accurate nomenclature in asbestos regulations the numbers listed in the table below are now available.

[1]42 F.R. 63353-65, December 15, 1977
[2]41 F.R. 10223, March 10, 1976
[3]43 F.R. 54066-7, November 17, 1978
[4]39 F.R. 24316, July 1, 1974
[5]43 F.R. 56668, December 4, 1978
[6]46 F.R. 8209, January 26, 1981
[7]Berger, H. and Oesper, R.E.: Asbestos Fundamentals. New York, Chemical Publishing Company, Inc., 1963, pp. 1-2
[8]Hodgson, A.A.: Fibrous Silicates, Lecture Series, 1965, No. 4. London, The Royal Institute of Chemistry, p. 1
[9]Campbell, W.J., Blake, R.L., Brown, L.L., Cather, E.E., and Sjobert, J.J.: Selected Silicate Minerals and Their Asbestiform Varieties, Bureau of Mines Information Circular/1977, I.C. 8751, United States Department of the Interior.
[10]Leake, B.E.: Nomenclature of amphiboles. Am. Min. 63, 1023-1052 (1978).

CHEMICAL ABSTRACTS SERVICE NUMBERS OF THE ASBESTOS MINERALS AND THEIR NON-ASBESTIFORM VARIETIES

ASBESTIFORM VARIETY (Asbestos, CAS No. 1332-21-4*)		NON-ASBESTIFORM VARIETY	
SERPENTINE GROUP			
chrysotile	(CAS No. 12001-29-5)	antigorite	(CAS No. 12135-86-3)
AMPHIBOLE GROUP			
crocidolite	(CAS No. 12001-28-4)	riebeckite	(CAS No. 17787-87-0)
grunerite asbestos (amosite)	(CAS No. 12172-73-5*)	grunerite	(CAS No. 14567-61-4)
anthophyllite asbestos	(CAS No. 77536-67-5*)	anthophyllite	(CAS No. 17068-78-9)
tremolite asbestos	(CAS No. 77536-68-6*)	tremolite	(CAS No. 14567-73-8)
actinolite asbestos	(CAS No. 77536-66-4*)	actinolite	(CAS No. 13768-00-8)

The presence of an asterisk (*) following a CAS Registry Number indicates that the registration is for a substance which CAS does not treat in its regular CA index processing as a unique chemical entity. Typically, this occurs when the material is one of variable composition, a biological organism, a botanical entity, an oil or extract of plant or animal origin, or one that includes some description of physical specificity, such as morphology. These materials are being registered currently to support the substance identification needs of federal regulatory agencies.

Examples of such registrations in the mineral area are 1332-21-4* *Asbestos*, 1332-58-7* *Kaolin*, and 70892-59-0* *Montmorillonite, calcined*. CAS Registry Numbers which include the asterisk do not appear in routine CAS abstract and index services. Materials identified by CAS Registry Numbers which include an asterisk will usually be found indexed either in the *CA General Subject Index* or as incompletely defined derivatives of specific chemical substances in the *CA Chemical Substance Index*; the corresponding Registry Number will not be included as part of the index entry.